

N-NITROSODIMETHYLAMINE

N-Nitrosodimethylamine is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 62-75-9

$(\text{CH}_3)_2\text{NNO}$

Molecular Formula: $\text{C}_2\text{H}_6\text{N}_2\text{O}$

N-Nitrosodimethylamine is a volatile, yellow, oily liquid of low viscosity. It is soluble in water, alcohol, ether, organic solvents, and lipids (Merck, 1983). The compound is sensitive to light, especially ultraviolet light, and undergoes relatively rapid photolytic degradation. When heated to decomposition, it emits toxic fumes of nitrogen oxides (NTP, 1991).

Physical Properties of N-Nitrosodimethylamine

Synonyms: n-methyl-n-nitrosomethanamine; dimethylnitrosamine; DMN; DMNA

Molecular Weight:	74.08
Boiling Point:	151 - 153 °C
Vapor Density:	2.56 (air = 1)
Density/Specific Gravity:	1.0048 at 20/4 °C (water = 1)
Vapor Pressure:	2.7 mm Hg at 20 °C
Log Octanol/Water Partition Coefficient:	-0.57
Conversion Factor:	1 ppm = 3.03 mg/m ³

(HSDB, 1993; Merck, 1983; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

N-Nitrosodimethylamine is used as an industrial solvent, an antioxidant, an additive for lubricants, a softener of copolymers, in the inhibition of nitrification in soil, in the preparation of thiocarbonyl fluoride polymers, as a plasticizer for rubber and acrylonitrile polymers, as a rubber accelerator, and as a research chemical. It has been found in wastewater effluents, dried sludge, diesel and gasoline engine exhaust, and in emissions from foundry, rubber, chemical, dye, leather, fish processing, and surfactant operations industries (HSDB, 1993). It may be present in food and beverages, tobacco smoke, herbicides, pesticides, and drinking water (NTP, 1991).

The primary stationary sources that have reported emissions of n-nitrosodimethylamine in California are manufacturers of guided missiles and space vehicles and parts (ARB, 1997b).

B. Emissions

The total emissions of N-nitrosodimethylamine from stationary sources in California are estimated to be less than 1 pound per year, based on data reported under the Air Toxics “Hot Spots” Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

N-Nitrosodimethylamine can be formed by the reaction of nitrates with dimethylamine produced by intestinal bacteria. It is also formed by the action of nitrate-reducing bacteria (HSDB, 1993).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of N-nitrosodimethylamine. However, the United States Environmental Protection Agency (U.S. EPA) has compiled ambient data from several locations throughout the United States during 1975. The overall mean concentration was 2.4 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

The primary source of N-nitroso compounds in indoor air is environmental tobacco smoke. A recent study conducted for the ARB measured emissions of six commercial cigarettes and one reference cigarette. N-nitrosodimethylamine had an average emission of 0.88 nanograms per milligram of tobacco or 0.57 micrograms per cigarette (Daisey et al., 1994).

Concentrations of N-nitroso compounds have not been measured in any statistically selected sample of residences in California or the United States (Hodgson and Wooley, 1991).

ATMOSPHERIC PERSISTENCE

The dominant tropospheric loss process for N-nitrosodimethylamine is photolysis. The calculated half-life and lifetime of N-nitrosodimethylamine due to photolysis is estimated to be 3 minutes and 5 minutes, respectively (Atkinson, 1995). The products of the photolysis of N-nitrosodimethylamine in air containing nitrogen oxides are dimethylnitramine, and methylmethyleamine (Tuazon et al., 1984).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program (AB 2588). Of the risk assessments reviewed as of April 1996, N-nitrosodimethylamine contributed to the total cancer risk in 2 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million (OEHHA, 1996a).

HEALTH EFFECTS

Probable routes of human exposure to N-nitrosodimethylamine are inhalation, ingestion, and dermal contact (NTP, 1994).

Non-Cancer: Overexposure to N-nitrosodimethylamine may cause liver damage. Symptoms include jaundice, nausea, vomiting, and malaise. The U.S. EPA has not established an oral Reference Dose (RfD), and the Reference Concentration (RfC) for N-nitrosodimethylamine is under review (Sittig, 1991; U.S. EPA, 1994a).

No information is available on the reproductive or developmental effects of N-nitrosodimethylamine in humans. N-Nitrosodimethylamine, when administered to pregnant rats and mice by several routes, has been shown to cause cancer in the offspring (U.S. EPA, 1994a).

Cancer: Data from human studies are of limited use because human exposure to nitrosamines generally results from contact with mixtures of these compounds. Increased incidences of liver, kidney, and lung tumors have been observed in rats and mice that inhaled N-nitrosodimethylamine. Liver tumors have also been observed in orally exposed rats (U.S. EPA, 1994a).

The U.S. EPA has placed N-nitrosodimethylamine in Group B2: Probable human carcinogen. The U.S. EPA has calculated an inhalation unit risk of 1.4×10^{-2} (microgram per cubic meter)⁻¹ for N-nitrosodimethylamine. The U.S. EPA estimates that if an individual were to breathe air containing N-nitrosodimethylamine at $7 \times 10^{-5} \mu\text{g}/\text{m}^3$ over an entire lifetime, that person would theoretically have no more than a 1 in 1 million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer has placed N-nitrosodimethylamine in Group 2A: Probable human carcinogen (IARC, 1987a).

The State of California under Proposition 65 has determined that N-nitrosodimethylamine is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California is 4.6×10^{-3} (microgram per cubic meter)⁻¹ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to $1 \mu\text{g}/\text{m}^3$ of N-nitrosodimethylamine is estimated to be no greater than 4,600 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 16 (milligram per kilogram per day)⁻¹ (OEHHA, 1994).

